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DRYOPTERIS CELSA (DRYOPTERIDACEAE) AND *E.J. PALMER 29404*: SOLUTION OF A TEXAS MYSTERY

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ABSTRACT

A study of the specimens of *E.J. Palmer 29404* from Bowie County, Texas, validates the occurrence of *Dryopteris celsa* in Texas and discloses that the specimens are mixed in various combinations with *Osmunda cinnamomea* (Osmundaceae).
KEY WORDS: *Dryopteris*, Dryopteridaceae, *Osmunda cinnamomea*, Osmundaceae, Texas, E.J. Palmer.

Dryopteris taxonomy has been problematic in Texas, although the genus is represented by only five species (Mink et al. 2010). This has been caused by several factors, one being the difficulty in delineating the genus *Dryopteris* from *Thelypteris*. For example, Gould (1962) included eight species of *Dryopteris* in his checklist of Texas plants. Of these eight, only *D. felix-mas* (L.) Schott, is presently known to occur in the state. The other species are now placed in *Thelypteris* or its segregates. Also complicating the systematics have been an underestimation of geographic distributions (e.g. *Dryopteris celsa* by Small 1938) as a result of misidentification (as discussed here) and the occurrence of hybridization within the genus.

The North American species of *Dryopteris* are widely distributed throughout northern temperate areas and freely hybridize (Wagner 1971; Walker 1962). These hybrid relationships are well-established (e.g., fertile and sterile crosses) and acknowledged (Wagner 1943), but this hybridization intensifies the difficulty and complexity of species identification in the field (Wagner & Musselman 1979; Lellinger 1985; Montgomery & Wagner 1993; Peck 2000). Despite fair understanding of hybrid relationships, identification of hybrid *Dryopteris* has confused definitive confirmation of distinctive morphological characters and subsequent nomenclature of the genus. Although no species of *Dryopteris* were described from Texas vouchers, parent taxa names were imported from areas where hybridization was common. This hybridization is relevant to the Texas fern flora because names of various fertile tetraploids (e.g., *D. celsa* and *D. cristata*) were reflected in the identification of historic Texas collections by reference to more eastern and northern taxa (i.e., *D. cristata*). Fertile tetraploids ultimately have become recognized as part of the modern Texas flora (e.g., *D. celsa* and *D. ludoviciana*), even though parental taxa do not occur in the state.

Inclusion of *Dryopteris cristata* (L.) A. Gray in Texas and controversy regarding the presence or absence of *D. celsa* (W. Palmer) Knowlton, W. Palmer, & Pollard in Texas is primarily associated with interpretation *E.J. Palmer 29404* (GH, MO, UMO), which was collected along "Margins of sandy bog, near Texarkana, Bowie County, Oct. 27, 1925." The specimen was determined to be *D. cristata* (in part) by Correll (1956). This determination was included in the floristic account by Correll and Johnston (1970, 1972) and Correll and Correll (1972). Complicating the identification has been the mixed nature of these specimens, which is the subject of this paper. Two of the specimens distributed under this number are now known to be a mixture of *Osmunda cinnamomea* L. and *D. celsa*.

For this study, four herbarium sheets of *Palmer 29404* were located — two at MO and one each at UMO and GH. The MO and UMO specimens were received on loan, while the GH specimen was studied from a high resolution digital image. The original labels of all four sheets identified the ferns as *Osmunda cinnamomea*.

The UMO sheet (Fig. 1) contains one frond, identifiable as sterile *Osmunda cinnamomea* by the cinnamon colored woolly hairs in the axils of the pinnae. As written on the sheet, the specimen was from the herbarium of E.J. Palmer and was a gift to the University of Missouri. There are no annotations on this sheet. Since this was in the collector's personal herbarium, it is presumed to be the "best" sheet and suggests that *O. cinnamomea* was the object of the collection. This was confirmed by reference to Palmer's field notebook, where he indicated that *29404* is *O. cinnamomea* (R.C. Kennedy, pers. comm.). This specimen may be involved with circumstances surrounding the exclusion of *Dryopteris celsa* from Texas in the Flora of North America (Montgomery & Wagner 1993).

Two sheets of *Palmer 29404* are housed at MO (Figs. 2, 3). MO 925450 has a sterile *Osmunda cinnamomea* frond, identified by the cinnamon colored hairs at the bases of the pinnae and more or less entire margins of the pinnae. MO 2139996 consists of a sterile frond of *Dryopteris celsa*, which is distinguished from *Osmunda* by the brownish to tan triangular scales at the base of the stipe and pinnules, serrated margins of the pinnae, and presence of foveolae near the margins of the upper surface of the leaf. The vein in the foveola is swollen into a clavellate shape of ca. 0.2 mm long and ends before reaching the margin. Several lines of evidence indicate that these two specimens once constituted a single sheet: conventional practice would prohibit two sheets of the same number (or specimen) sent to the same place in exchanges; the label of MO 2139996 (*D. celsa*) is photocopied, as determined by the "toner" nature of the print, abundance of toner specking over the surface, and lack of impact type impressions found on the labels of the other sheets distributed under this number; the label is smaller in size (10.7 × 5.9 cm vs. 10.8 × 7 cm) than the labels of other specimens with this number; and the higher accession number of the *Dryopteris* sheet, which is suspicious. That these two specimens were originally mounted on a single sheet is confirmed by Correll's (1956) statement:

> "A frond of this species [*Dryopteris cristata*; a misidentification of *D. celsa*] is mounted with a frond of *Osmunda cinnamomea* on sheets in the Herbarium of the Missouri Botanical Garden and the Gray Herbarium. Although an error in mounting the specimens on the herbarium sheets might have occurred, the fact that two sheets in two different herbaria, labeled "*Osmunda cinnamomea*," each have a frond of this species and of *cinnamomea* would not appear to substantiate this assumption. It appears more likely that the mixture of fronds of the two species was obtained in the field and was distributed accordingly" (pp. 151–153).

This also lends support to the fronds being collected at the same time and place (i.e., Bowie Co., Texas). The two specimens (prior to removal to separate sheets) were annotated by Correll using an offset printed annotation label. Across the top was printed "ANNOTATION LABEL." Under this was inked in blue: "*Dryopteris cristata* (L.) Gray." Immediately below this was inked in "*Osmunda cinnamomea* L." Further below the *Osmunda* annotation was offset-printed "DETERMINED BY DONOVAN S. CORRELL," followed by a handwritten "1951" at the right margin. Upon separation of the fronds, the annotation label was removed from the original sheet and split lengthwise between the two binomials, as determined by the matching proportions of the raw cut edges. To the *Dryopteris* portion (upper half) of the label was written in: "det. Donovan S. Correll 1951," but not in the hand of Correll. This was affixed to a new herbarium sheet (MO 2139996) with the photocopied label and *Dryopteris* frond. Two additional annotations are now on the sheet, one by T.H. Peck 1985, the other by R. Cranfill 1981, both identifying the specimen as *D. celsa*. The *Osmunda cinnamomea* specimen was also removed from the original sheet and remounted on a new herbarium sheet, along with the original label. The elliptical Missouri Botanical Garden stamp with the accession number (MO 925450) was cut from the original sheet and glued to this new sheet. The original label and accession number were included with the *Osmunda* sheet, possibly because it made the identification correct and may have been presumed to be what Palmer intended to collect. In addition to this information on the herbarium sheet, the bottom portion of the cut annotation label identifying the specimen as *O. cinnamomea* was included. A small part of the lower left corner is missing from this annotation label but is otherwise visibly unaltered after being sectioned. Since the now-*Osmunda* sheet (MO 925450) is not annotated by anyone other than Correll, who saw the two fronds mounted on the same sheet, it is assumed that no one else has critically studied the specimen, possibly because there is no reason to assume there is more than one *Palmer 29404* specimen in the same herbarium. Mention must be made that the annotation of these two sheets was not done by Correll, but by an unknown person using Correll's original annotation label, but in a doubly altered form (cut and amended). It appears reasonable to assume that the original mixed specimens were mounted in the mid to late 1920s, shortly after its collection in 1925. It is likely that the specimens were split and remounted in the early 1970s (a time when photocopying was developed enough to achieve acceptable reproduction). According to John Pruski (pers. comm.) of the Missouri Botanical Garden, MO 2300000 was mounted in 1976, making the separation date above proximate. He also said MO splits mixed sheets when they are noticed, and then the policy is to write on each sheet what was formerly mixed with it. Unfortunately, such notation was not done in this case.

The GH sheet (Fig. 4) has sterile fronds of *Dryopteris celsa* (left) and *Osmunda cinnamomea* (right) on it. The *Osmunda* determination is confirmed by Correll as "! DSC" in his hand. No date is given. Near the *Dryopteris* frond is penciled "*Dryopteris cristata* (L.) A. Gray" followed below with "! DSC 1947." Comparison of handwriting shows that none of this appears to be in the hand of Correll. Generally, the exclamation mark before a name (or initials) means that the person considers the determination as correct, in this case, the *Osmunda* frond. Lack of an exclamation mark means a new or initial determination is made and the new name written in. Nonetheless, the identification of the *Dryopteris* frond is incorrect — the specimen is *D. celsa*, not *D. cristata*.

Correll (1956) mentioned the mixed nature of the GH sheet and the original unseparated MO sheet and used in his citation of *Dryopteris cristata* in Texas as "*Palmer 29404* (in part)." The mixed nature of the sheets was also explained in the discussion following the specimen citation (see above). This was also mentioned in Correll and Johnson (1970, 1972) and Correll and Correll (1972), as "*Palmer 29404*, p.p.," but in these circumstances no further explaination was afforded as in Correll (1956). Since Correll (1956) never examined the UMO sheet, he didn't know the full extent of the mixture. Nor could he have been aware of the later separation of the fronds on the MO sheet. Later workers should have been alerted to the alterations in the now two MO specimens through a literature review of the references mentioned in this paragraph, or, if examining both MO specimens, the

unusual appearance of the sheets. Other than for the current authors, there is no evidence that anyone else has examined both sheets.

The above mentioned misidentification by Correll, unequally mixed sheets, and later separation of specimens have combined to create a perplexing situation that could only be untangled by examination of all the specimens involved. Other than the misidentification, only Correll (1956) correctly assessed the problem. For other botanists, the outcomes depended upon which specimen(s) was/were studied. In summary, the UMO specimen is *Osmunda cinnamomea*, the GH specimen is mixed (*Dryopteris* celsa and *O. cinnamomea*), while the originally mixed MO sheet has been split into two specimens, one [MO 925450] is *O. cinnamomea* and the other [MO 2139996] is *D. celsa*. Finally, this does eliminate the confusion associated with the reports of *D. celsa* in Texas.

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Figure 1. *Osmunda cinnamomea* (*E.J. Palmer 29404*, UMO).

Figure 2. *Osmunda cinnamomea* (*E.J. Palmer 29404*, MO). Separated from *Dryopyeris celsa* on original MO sheet (see text).

Figure 3. *Dryopyeris celsa* (*E.J. Palmer 29404*, MO). Separated from *Osmunda cinnamomea* on original MO sheet (see text).

Figure 4. GH sheet of *E.J. Palmer 29404*, composed of *Dryopteris celsa* (left) and *Osmunda cinnamomea* (right).